

TECHNOLOGY BRIEF

July 2002

Compaq Computer
Corporation

ISS Technology
Communications

CONTENTS

64-Bit Computing Overview	3
Maximum Performance and Innovative Technology	4
ProLiant DL590/64 Server Architecture	4
System Board Design	7
Distributed Power System	8
Cooling	9
Maximum Uptime	11
PCI Hot Plug Technology	11
Redundant Network Interface Controller Technology	11
Redundant Power System	12
Redundant Hot-Plug Fans	13
Hot-Plug Hard Disk Drives	13
Integrated Smart Array Controller	14
Rapid Deployment and Maintenance	15
Modularity and Serviceability	15
Manageability	16
Commitment to Industry-Standard 64-Bit Computing	18
Conclusion	19

ProLiant DL590/64 Server Technology

The computer industry has entered the next stage of a multi-year transition that is bringing the benefits of 64-bit computing to industry-standard architectures. Industry-standard 64-bit solutions, based on Intel Itanium processors will establish a solid foundation to deliver the performance, innovation, and price essential to businesses for many years to come.

Compaq has incomparable advantages in leading this technology shift. In addition to a 5-year investment in 64-bit industry-standard server technology, Compaq has a multi-year technology and marketing agreement with Intel to accelerate the availability of next-generation enterprise servers based on the Intel Itanium processor family. Microsoft and Compaq have continued a two-decade-long partnership to deliver one of the most stable and reliable industry-standard computing platforms in the market by working hand in hand to develop the Windows 64-bit server family. Aside from the tight integration work with Intel and Microsoft, Compaq has been collaborating with independent software vendors (ISVs) and early adopter companies to port 32-bit applications or develop 64-bit applications on the new ProLiant platform.

The ProLiant DL590/64 server represents the official entry from Compaq into the world of high-performance industry-standard 64-bit computing. With this introduction of the Itanium-based server, Compaq strengthens its enterprise product portfolio by delivering an industry-standard platform with enterprise-class performance.

This technology brief gives an overview of 64-bit computing. It explains the technologies implemented in the ProLiant DL590/64 server and describes development efforts Compaq has taken to ensure that reliable and stable 64-bit solutions are available.

Please direct comments regarding this communication to the ISS Technology Communications Group at this Internet address: TechCom@hp.com

COMPAQ

NOTICE

Compaq shall not be liable for technical or editorial errors or omissions contained herein. The information is provided “as is” without warranty of any kind and is subject to change without notice. The warranties for Compaq products are set forth in the express limited warranty statements accompanying such products. Nothing herein should be construed as constituting an additional warranty.

Compaq, the Compaq logo, Compaq Insight Manager, ProLiant, ROMPaq, SmartStart, and NetFlex are trademarks of Compaq Information Technologies Group, L.P. in the U.S. and/or other countries.

Microsoft and Windows are trademarks of Microsoft Corporation in the U.S. and/or other countries.

Intel, Intel Xeon, Itanium, Pentium, Pentium II Xeon, Pentium III Xeon, and Pentium 4 are trademarks of Intel Corporation in the U.S. and/or other countries.

UNIX is a trademark of The Open Group in the U.S. and/or other countries.

All other product names mentioned herein may be trademarks of their respective companies.

©2002 Compaq Information Technologies Group, L.P.

Compaq Computer Corporation is a wholly owned subsidiary of Hewlett-Packard Company.

ProLiant DL590/64 Server Technology

First Edition (July 2002)

Document Number TC020702TB

64-BIT COMPUTING OVERVIEW

At its simplest level, 64-bit processing means the registers and execution units within the processor can access addresses and manipulate data that are 64 bits wide. Although 32-bit microprocessor architecture has 64-bit data paths, its internal registers and execution units only access addresses and manipulate data that are 32 bits wide. True 64-bit computing requires not only the 64-bit characteristics of the processor, but also a 64-bit operating system (OS). The characteristics of a 64-bit computing environment include very large files and file systems, large amounts of system and virtual memory, and a large memory addressing space.

For most enterprise applications, the greatest immediate impact of 64-bit computing is the ability to address a significantly larger pool of system memory—as much as 64-gigabytes (GB) with the first 64-bit processor and chipset from Intel and, theoretically, more than 700 terabytes with subsequent processors on the Intel roadmap. Addressing larger system memory pools will allow applications to run faster while handling larger data sets. Early 32-bit Intel Architecture (IA-32) processors could directly address only 4 GB of system memory; more recent IA-32 processors can directly address up to 16 GB of system memory. Initial implementations of 64-bit Intel Architectures (IA-64) will allow direct, high-speed access to 64 GB of system memory. The large 64-bit address space allows 4 billion times as many memory addresses as 32-bit systems, resulting in a theoretical physical memory limit into the exabytes.

As memory density increases and relative cost of memory decreases, it becomes feasible to implement system memory in the hundreds of GB, enabling significant performance improvements for large, memory-intensive enterprise applications. The benefits of larger system memory pools include:

- Faster access to huge amounts of data in memory—a significant advantage for customers who use large databases
- Increased capacity for more users
- Greater application performance due to less page swapping and fewer page faults
- Easier communication between programs to share code and data
- Better manipulation of huge data sets
- Solutions for larger and more complex requirements

Customers with power-hungry applications such as decision support, database management, data mining, data warehousing, and e-commerce will see significant performance improvements through the adoption of 64-bit solutions.

Applications requiring higher floating point capabilities, such as number crunching, analytics, rendering, and high-performance technical computing (HPTC) will also see performance advantages over 32-bit systems. As compilers mature, many software vendors and HPTC companies will be investigating IA-64 systems as an alternative to UNIX platforms.

Where the benefits of IA-64 can be recognized, many software vendors and companies with custom code are using IA-64 systems as a development platform for porting their code. Since any code that is ported on IA-64 systems can easily be migrated to the follow-on platform based on the next-generation 64-bit processor, it makes sense that these companies start early to increase their competitiveness in the market.

*ECC – Error Checking
and Correcting
SDRAM – Synchronous
Dynamic Random Access
Memory*

*PCI – Peripheral
Component Interconnect*

MAXIMUM PERFORMANCE AND INNOVATIVE TECHNOLOGY

The ProLiant DL590/64 server incorporates the new four-way Intel Itanium-based processors and larger ECC SDRAM configurations to deliver the maximum performance and availability required for Itanium-based applications in four-processor compute environments. Innovative ProLiant technology adds reliability, features such as redundant power distribution, and efficient system board and cooling designs.

ProLiant DL590/64 Server Architecture

The ProLiant DL590/64 server is Compaq's first Itanium-based product. The architecture (Figure 1) uses the Intel 82460GX chipset. The chipset includes a 133-megahertz (MHz) front-side bus that uses both edges of the clock cycle to produce 266 megatransfers per second and supports dual memory boards and up to four Intel Itanium processors. The ProLiant DL590/64 server architecture also includes support for up to 64 GB of industry-standard 100-MHz SDRAM and up to four PCI bridges with a total of 11 slots.

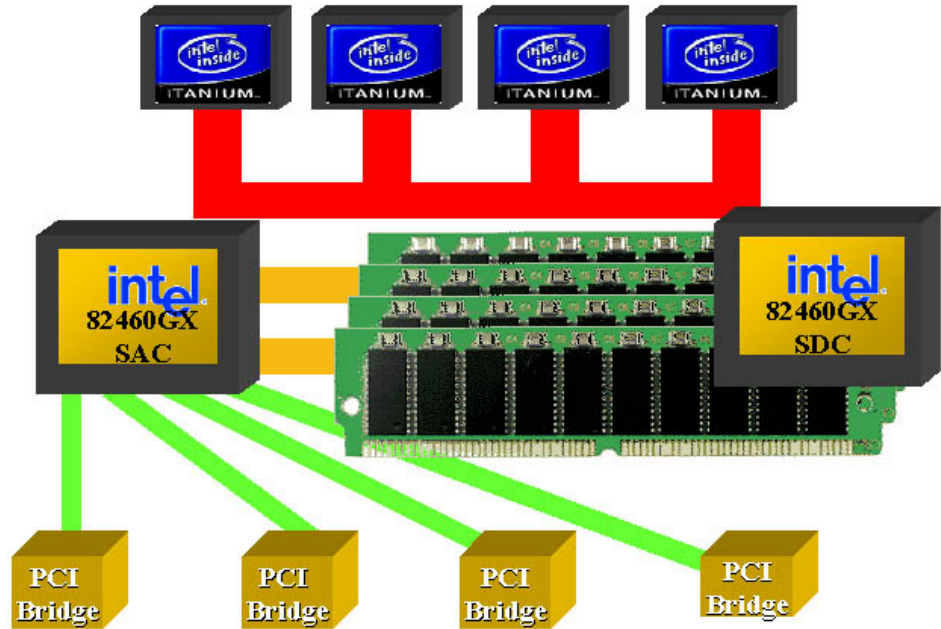


Figure 1: Diagram of ProLiant DL590/64 server architecture.

Processors

The ProLiant DL590/64 server includes support for up to four 733-MHz or 800-MHz Itanium-based processors. The 733-MHz processors support a 2-megabyte (MB) Level 3 cache, while the 800-MHz processors support a 4-MB Level 3 cache.

The IA-64 architecture enables greater parallelism than traditional architectures by combining static and dynamic scheduling, using speculative execution, and predicting code branches better than traditional architectures. To realize the performance improvements of this greater parallelism, the Itanium processor has additional hardware resources: 128 general-purpose integer registers, 128 floating point registers, 64 predicate registers, and many execution units with parallel instruction dispatch (which allows executing multiple instructions in parallel).

In addition, the floating point performance of Itanium processors is significantly better than that of today's IA-32 processors. The Itanium processor has two extended-precision and two single-precision floating point units, capable of executing up to four extended-precision or eight single-precision floating point operations per clock cycle.

The Itanium processor uses a high-performance architecture, Explicitly Parallel Instruction Computing (EPIC), which is based on very long instruction word (VLIW) systems. This architecture achieves a new level of parallelism. New parallel-processing features include:

- Hardware support for multiple parallel data streams
- Fewer memory latencies than traditional architectures
- Better anticipation of instruction streams that can be made parallel
- Support of more parallel streams
- A third level of caching
- Making data parallel before it enters the microprocessor

Because the Itanium processor has the resources to support more registers, functional units, logic, instructions, cache, and data, it delivers increased processing power. It also links the program compilers more closely to the processor for more efficient execution of parallel instructions and optimized application performance. Current IA-32 processors, on the other hand, exclusively use hardware within the processor to decide which instructions can be executed simultaneously. The Itanium processor uses a new instruction set designed for optimal performance with the EPIC architecture.

The Itanium processor is also capable of executing IA-32 (x86) instructions, so it accommodates the transition from IA-32 environments to IA-64 environments. While running an IA-32 application, the processor is switched to an IA-32 mode. When the user returns to the 64-bit OS or launches an IA-64 application, the processor is switched back to IA-64 mode. For IA-32 applications running under a 64-bit OS that supports IA-32 applications and drivers, the OS manages the processor mode switching. While some 32-bit software is compatible with the Itanium processor, applications achieve higher performance when they are ported to 64-bit versions.

Itanium processors are installed in sockets on the motherboard. A new physical form factor (Figure 2) provides four times the bandwidth of the 330-contact slot connector design used in Pentium II Xeon and Pentium III Xeon processors.



Figure 2: The Itanium processor uses a new physical form factor.

Memory

The ProLiant DL590/64 server supports up to 64 GB of industry-standard 100-MHz ECC SDRAM. Two memory boards provide 32 dual inline memory module (DIMM) sockets each to accommodate a total of 64 DIMMs (see Figure 3). One memory board attaches to the top of the processor board, and one memory board attaches to the bottom.

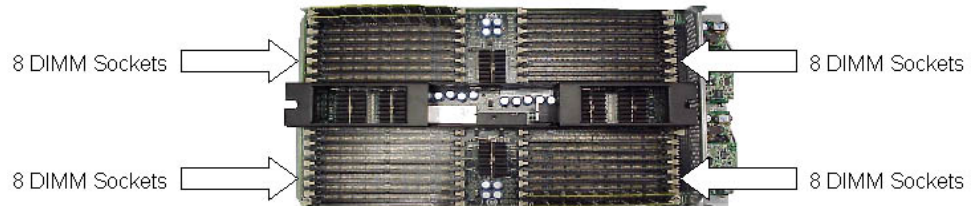


Figure 3: Each memory board in the ProLiant DL590/64 server supports up to 32 DIMMs.

Advanced ECC memory technology with single-bit error correction and double-bit and nibble error detection technology is integral to the Intel 82460GX chipset. Advanced ECC memory improves data integrity of servers and significantly reduces the probability of fatal memory errors. With fewer memory errors, overall availability of the server improves.

The ProLiant DL590/64 server comes standard with 1 GB (733-MHz model) or 4 GB (800-MHz model) of memory. The 733-MHz model comes with one memory board supporting 32 DIMM sockets; the 800-MHz model comes with two memory boards supporting up to 64 GB of memory using 1-GB DIMMs. The 733-MHz model may be upgraded with an additional, optional memory board. Memory is expandable, four DIMMs at a time, to a maximum total of 64 GB.

Compaq strongly recommends using DIMMs supplied by Compaq because of the rigorous testing they undergo in ProLiant systems. However, the ProLiant DL590/64 supports industry-standard 168-pin PC100 CL2 ECC Registered DIMMs with some restrictions¹. The use of DIMMs that do not adhere to these restrictions may result in error messages and possible loss of data.

I/O

Additional performance for the ProLiant DL590/64 server is provided with a powerful 64-bit I/O subsystem. The server has eight 64-bit, 66-MHz hot-plug PCI slots and three 64-bit, 33-MHz slots (Figure 4). Slots 1, 10, and 11 operate at 5 volts and run at 33 MHz only. Slots 2 through 9 operate at 3.3 volts and will run at 33 MHz or 66 MHz.

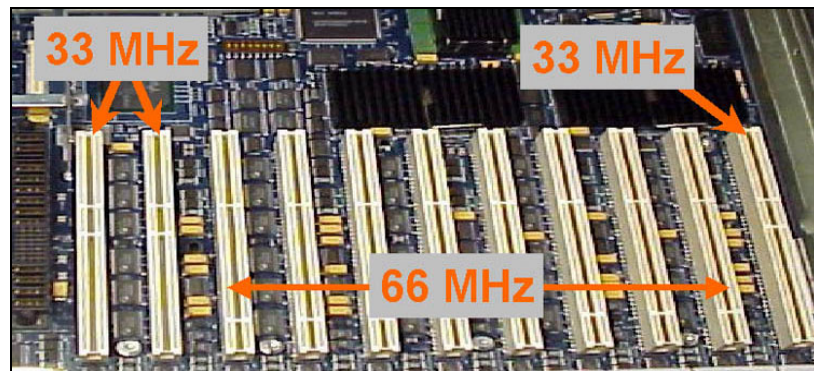


Figure 4: The ProLiant DL590/64 implements 64-bit PCI technology.

¹ Check with your authorized Compaq representative for more information on these restrictions and correct memory usage.

Implementing 64-bit, 66-MHz PCI technology increases bandwidth to a theoretical 532 MB per second, double the bandwidth of 33-MHz implementations. Although 3.3-volt, 33-MHz cards may be plugged into the 66-MHz slots, no performance benefit will be achieved. In fact, doing so will slow down the PCI bus such that all slots on the same bus will operate at 33 MHz, potentially reducing the performance of any 66-MHz device in another slot on that bus.

As long as the proper 64-bit drivers have been installed to interface with the Itanium system, 32-bit PCI cards may be plugged into the 64-bit PCI slots. However, the 66-MHz slots have been keyed so that 5-volt PCI cards cannot be inserted. This eliminates the potential to damage the cards by inserting them into the wrong slots.

System Board Design

The Itanium processor and its power module (Figure 5) are much larger than the 32-bit Pentium III Xeon processor and its power module. They are also much heavier. Compaq engineers worked closely with Intel to drive innovations in the processor board design so form factor, modularity, and serviceability would not be sacrificed to accommodate the larger footprint and weight.

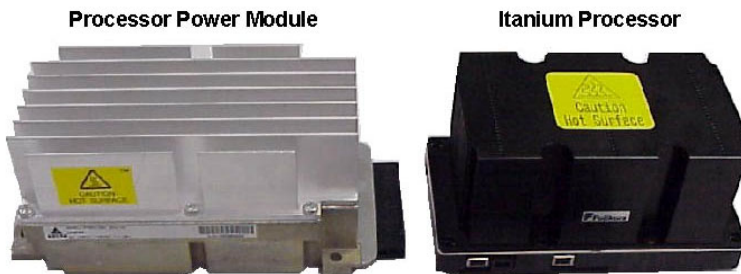


Figure 5: The Itanium processor and power module are much larger than the 32-bit Pentium Xeon processor and its power module.

For example, Compaq required the use of very high-density metric connectors to provide tool-free insertion and removal of the processor and memory drawer in the ProLiant DL590/64 server. Compaq also required that these connectors be placed on one side of the board. This enhances cooling by allowing the processor board to plug into a side plane instead of a midplane, which would restrict front-to-back airflow.

A dual-sided design allows the processor board to accommodate the four Itanium processors, associated power modules, and a maximum of 64 GB of memory in a mirror-image configuration. Of course, the more powerful processor and greater memory capacity place enormous power requirements on the server.

To handle these power requirements, Compaq designed the I/O board (Figure 6) and the side plane with an innovative bus bar technology. The bus bar accommodates the high current and high-speed buses that are routed through the board while keeping the layer count and cost of the board down.

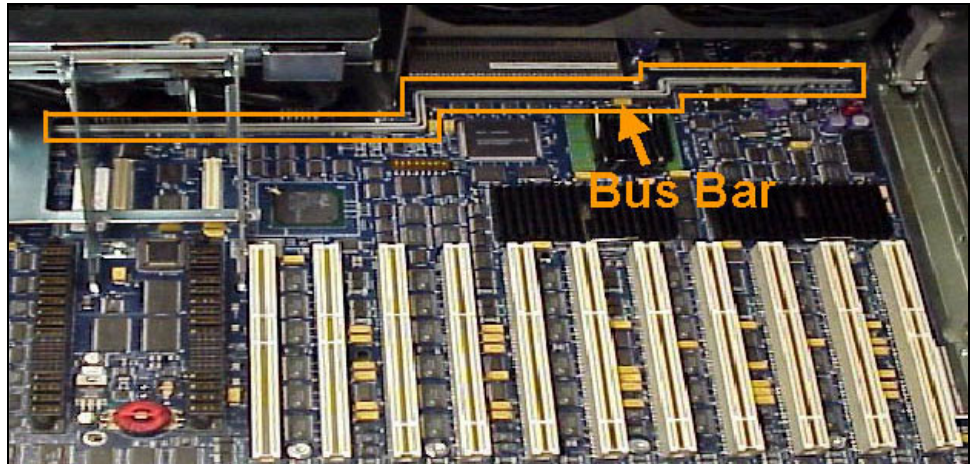


Figure 6: Compaq designed the ProLiant DL590/64 server's I/O board.

Distributed Power System

Historically, most ProLiant servers have been powered by one or more AC-to-DC, multiple output power supplies. Power from the power supplies is cabled or routed to all components of the server. This is known as centralized power distribution. This approach works well at moderate power levels. But as server performance has increased, so has the demand for more power.

To manage the increased power, the ProLiant DL590/64 server uses a hot-pluggable distributed power system that is fully redundant, including the high-line AC line feeds. In a distributed power system, a primary power supply converts power from the AC mains to an intermediate DC voltage that is easy to distribute throughout a server system. A common value is +48 volts DC, which is a level high enough to keep the currents low but within the safe voltage limits. At the load, a second power supply converts the high voltage to the required lower voltage. In the ProLiant DL590/64 server, these local power converters are known as system power modules. Throughout the industry, they are also known as point of load converters or voltage regulator modules (VRMs).

Since the system power modules are located next to the loads, the large cables and wires typical with high currents are no longer required. This allows a significant cost saving and a simpler design. System power modules are typically more reliable than the power supplies they replace.

Three 1250-watt primary power supplies in the front of the ProLiant DL590/64 server take in AC power. Each of these distributes 48 volts DC at up to 1200 watts (see Figure 7). These 48-volt supplies provide power to the processor power modules and to the memory boards. They also provide 48 volts to the three system power modules that convert the power into the 3.3 and 5-volts needed for PCI slots and logic and into the 12 volts needed for the server's fans and hard drives.

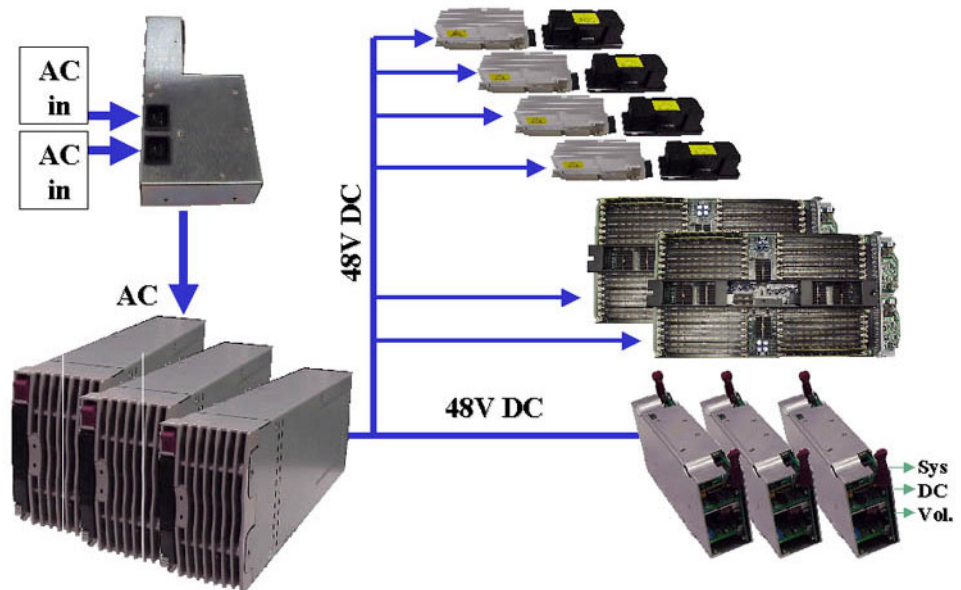


Figure 7: The ProLiant DL590/64 server uses a distributed power system.

For each system power module plugged into the system, a corresponding primary power supply must also be plugged in. This one-to-one relationship is required because each system power module depends on the fans in the corresponding primary power supply for cooling, and the redundancy helps maintain availability.

The primary power supplies and their associated system power modules are N+1 redundant and load balancing. When using high-line power, two of the primary power supplies can provide up to 2500 watts of power—more than the 2 kilowatts required by a fully loaded ProLiant DL590/64 server. The third power supply provides redundancy in a fully configured system.

A lightly loaded ProLiant 590/64 server may operate satisfactorily using low-line power; however, if low-line power is used, redundancy of the power supplies may be sacrificed and the server power demand may exceed the total amount of power available. Compaq strongly recommends using high-line power to operate ProLiant DL590/64 servers when possible.

All of the power supplies and system power modules in the ProLiant DL590/64 server are hot pluggable, so a failed power supply in a redundant configuration can be replaced while the server is up and running. Easy-to-use light-emitting diodes (LEDs) and levers simplify the identification and replacement of a failed power supply.

The ProLiant DL590/64 server has a built-in AC transfer switch that provides AC line redundancy. This feature allows the server to operate from either of two independent AC power sources. If a second AC power source is present and connected, the server will automatically switch to the second AC source if the primary source fails. The server will automatically switch back to the primary source as soon as it returns to its specified limits of operation. The AC line redundancy feature only functions with use of high-line power.

Cooling

The high-performance Itanium processors, massive amounts of memory, and other components in the ProLiant 590/64 server require unprecedented levels of power. As a result of this large power draw, heat generation is a critical issue that required careful consideration of server cooling and airflow.

Engineers began by designing the system board so that it could plug into a side plane to permit full front-to-back air movement. Baffles within the server help to direct airflow from the front of the server, past the components with critical cooling requirements, and out the back.

Two large, 6-inch fans in the rear pull air through the server and keep the system cool. Two additional 6-inch fans in the front of the server provide redundancy and blow air into the system if one of the rear fans fails.

Compaq engineers designed an entirely new fan to allow optimal placement within the ProLiant 590/64 server. To maintain parts consistency throughout the server, engineers designed the fan so that it could be used in both the front and back locations in the server (see Figure 8). This required that the connector be placed on the side of the fan. A fan ejector mechanism on the server moves the plug to and from the fan connector, giving the fan room to slide in at an angle and then lock into place. The mechanism is designed to make removal of the fans quick and easy. All four fans are hot pluggable and can be replaced one at a time while the system is running and mounted in the rack. LEDs on these fans are visible from both sides.

Fans in rear location



Fans in front location



Figure 8: The ProLiant DL590/64 uses the same fan design in both the front and back of the server.

A second fan (Figure 9) was designed to cool the system power modules, media bay, and PCI area of the server. Engineers modified an existing Compaq fan design so that it could be hot plugged from the top and placed in an optimal position to cool these components. The ProLiant DL590/64 server uses four of these hot-pluggable, redundant 6-inch fans.

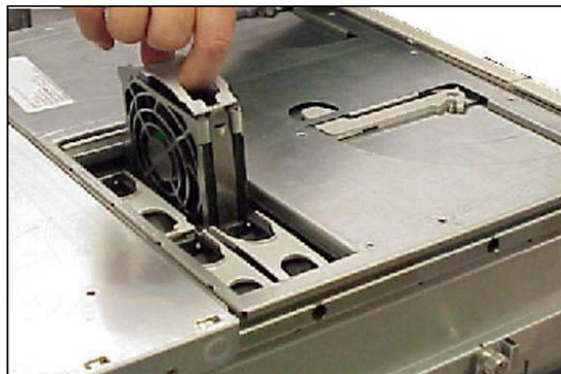


Figure 9: Four hot-pluggable, redundant 6-inch fans cool the system power modules, media bay, and PCI area of the server.

Built-in fans on the primary power supplies further enhance cooling in the server. The direct correspondence between these primary power supplies and system power modules also enhances cooling by directing airflow from the built-in fans through the server.

MAXIMUM UPTIME

The unstoppable combination of high-availability features and renowned Compaq reliability assure maximum uptime for data centers, HPTC, or e-commerce implementations. The ProLiant DL590/64 server delivers the best combination of high-availability features offered in any four-processor-capable, rack-optimized server.

The ProLiant DL590/64 offers such leading and robust high-availability features as Advanced ECC memory technology, proven PCI Hot Plug capabilities, truly redundant hot-plug system fans, hot-plug hard drives, hot-plug redundant power supplies, and an integrated Smart Array controller that provides embedded RAID functionality. Like all ProLiant servers, the ProLiant DL590/64 server undergoes thousands of hours of quality assurance, integration, optimization and testing for maximum reliability.

PCI Hot Plug Technology

The ProLiant DL590/64 server incorporates industry-standard PCI Hot Plug technology. This technology, pioneered by Compaq, adds hot-plug capabilities to existing PCI adapters for increased system availability and serviceability. Compaq led the industry by licensing its PCI Hot Plug implementation, thus broadening customer access to this industry-standard technology.

Compaq's implementation of PCI Hot Plug incorporates electronics into the server to control each PCI Hot Plug slot individually: a single slot can be powered down without affecting the operation of the others slots. Use of a hardware notification instead of a software notification ensures removal of the correct adapter card. PCI Hot Plug technology allows the following capabilities while the system is running:

- Hot replacement – replacing a single PCI adapter with a similar adapter
- Hot upgrade – replacing a PCI adapter with an upgraded adapter
- Hot expansion – adding a PCI adapter to an empty slot

Redundant Network Interface Controller Technology

Redundant network interface controller (NIC) technology allows two similar NICs to share a single instance of device driver code. One NIC becomes the active network controller and the other NIC acts as a standby controller. If the active NIC fails, the network traffic is automatically switched to the standby NIC. This redundancy eliminates the NIC or network cable as a single point of failure. With PCI Hot Plug technology, the failed NIC can be replaced without rebooting the server. Thus, the end user can have continuous service and the administrator can greatly reduce planned and unplanned downtime.

The ProLiant DL590/64 server supports a Compaq NC3134 Fast Ethernet controller on the PCI local bus. The NC3134 is a dual port, 10/100 modular NIC that features 64-bit, 66-MHz performance using Intel's latest networking silicon, the 82559 application-specific integrated circuit. The faster clock speed of the 66-MHz NIC delivers better performance than 33-MHz NICs because it moves data off the PCI bus faster, thereby freeing the bus for further use.

The NC3134 ships with advanced server features such as support for network fault tolerance. The NIC's dual ports allow customers to configure the NC3134. The modular design of the NC3134 enables user to upgrade to two additional 10/100 ports, to a 100-Mbps fiber port, or to Gigabit Ethernet SX or LX.

Redundant Power System

The power subsystem in the ProLiant DL590/64 server is completely redundant. Redundant line cords allow customers to provide two AC feeds to the server from different power grids (see Figure 10). The line cords connect to a switch in the back of the server that senses when AC power from the primary feed is beginning to fail. It immediately switches to the redundant feed with absolutely no downtime to the server. As soon as the primary feed returns to its specified limits of operation, the server will automatically switch back to the primary source. Note, however, that the AC line redundancy feature functions only with use of high-line power.

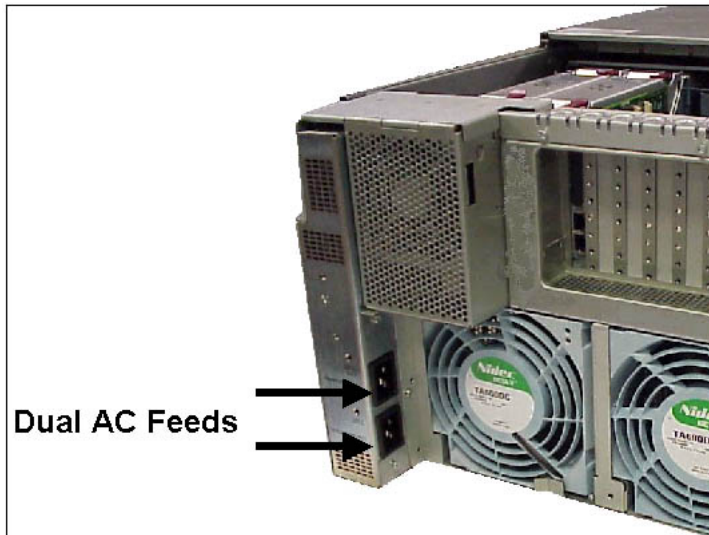


Figure 10: Dual AC feeds allow redundancy throughout the power subsystem.

The ProLiant DL590/64 server also uses intelligent, redundant, hot-plug power supplies to reduce downtime. The server supports three dual-rated 1250-watt/700-watt primary power supplies (Figure 11) to deliver 48 volts DC power to the server. In addition, three corresponding system power modules (Figure 12) convert the 48-volt DC power to provide 3.3, 5, or 12 volts to the server's components.

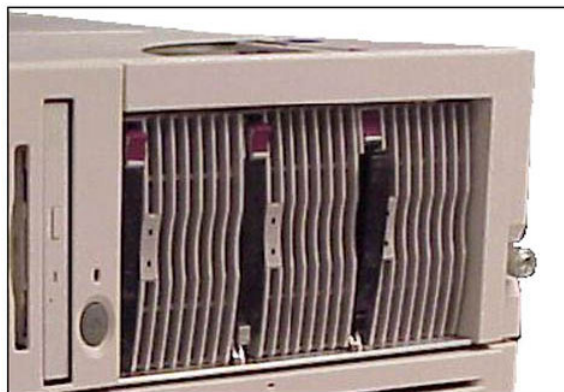


Figure 11: The ProLiant DL590/64 server supports three 1250-watt primary power supplies.

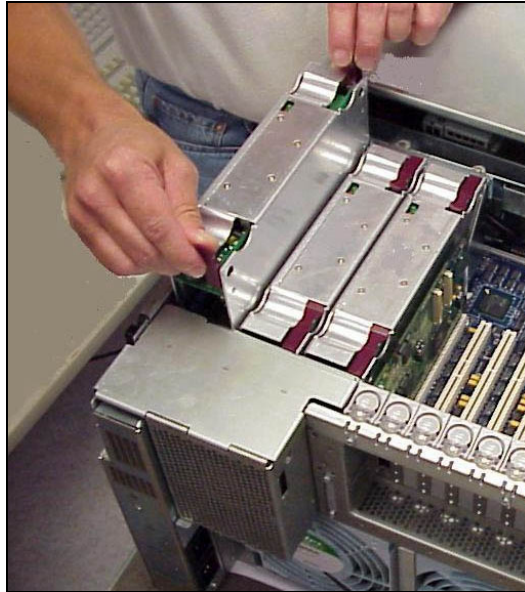


Figure 12: Three redundant, hot-plug system power modules provide DC power to the server's components.

The primary power supplies and their associated system power modules are N+1 redundant and load balancing. Two primary power supplies and system power modules can support a fully loaded ProLiant DL590/64 server; the third power supply and system power module provide redundancy. If one of the primary power supplies or system power modules fails, the redundant component takes the load while the failure is resolved. Since all the power supplies and system power modules are hot pluggable, a failed power supply can be replaced while the server is up and running.

Redundant Hot-Plug Fans

The ProLiant DL590/64 server includes two hot-plug system fans in the rear of the server; two fans in the front of the server provide redundancy. If one of the primary fans fails, a system alert triggers the associated secondary (or redundant) fan to take over automatically. The redundant hot-plug system fans protect the various server components from overheating and help prevent possible system interruption.

Four additional hot-pluggable, redundant fans cool the system power modules, media bay, and PCI area of the server. Two of these 6-inch fans are required to cool the components, and two more provide redundancy.

All of the fans in the ProLiant DL590/64 server are hot pluggable. They can be replaced while the server is up and running with absolutely no downtime.

Hot-Plug Hard Disk Drives

The ProLiant DL590/64 server supports four 1-inch, Wide Ultra-2 or Wide Ultra-3 SCSI, internal hot-plug hard disk drives. The internal drives can be controlled by an integrated Smart Array controller to optimize them for OS and boot support. When the server is configured for maximum capacity, it can support 291.2 GB of internal storage.

Integrated Smart Array Controller

The ProLiant DL590/64 server is equipped with an integrated Smart Array controller (Figure 13). The integrated controller, also known as RAID on a chip, or ROC, is an embedded hardware-based RAID solution that enhances system reliability and improves host processor utilization. It is ideal for data center servers where internal storage is optimized for OSs and swap space.

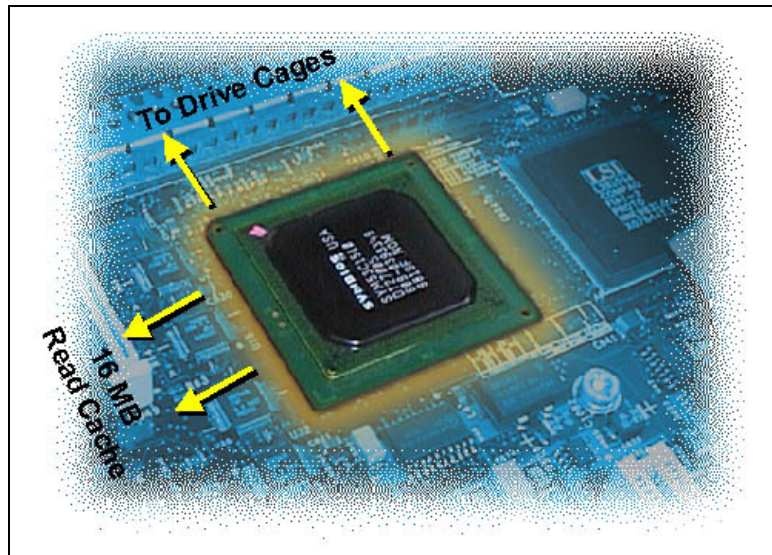


Figure 13: The ProLiant DL590/64 server includes an integrated Smart Array controller.

RAID implementation enhances data integrity and recovery through data striping and parity generation for the data rebuild process. The integrated array controller improves host process utilization by performing all RAID functions, thus freeing the host processor for other tasks. The controller is fully integrated and embedded on the motherboard of the ProLiant DL590/64 server, which improves I/O efficiency and frees a PCI slot for another controller. The integrated controller can also queue tasks and data, thereby increasing performance.

The integrated controller consists of a processor, memory controller and hardware exclusive-OR (XOR) engine, SCSI chip, PCI bridge, and an internal bus structure embedded on a single substrate. The controller has fewer parts than typical array controllers, since all of the components and connections are combined into one integrated circuit. With fewer parts, reliability is improved and mean time between failures is increased.

The integrated array controller includes a 16-MB read-only memory, with an 8-MB read-ahead cache. This memory configuration is optimal for OS and boot support. Since the memory is read only, data loss is not an issue and battery backup is not required.

Configuration Utilities

The Option ROM Configuration for Arrays Utility is firmware that comes with the integrated controller in the ProLiant DL590/64 server. This firmware allows users to set up a simple configuration during the power-on self-test (POST). The support includes the ability to create up to four logical drives, delete existing logical drives, view the current configuration, and assign an online spare as part of the logical drive creation process.

The Array Configuration Utility is provided for more advanced configuration support. The Array Configuration Utility is an easy-to-use graphical configuration utility to help users set up and change the drive array configurations. It can be used to configure the standard internal drive controller as well as any optional controller boards that are installed.

RAID Support

The integrated array controller supports RAID levels 0, 1, 0+1, and 5 to ensure data integrity and availability. When configured for RAID 5, the controller proactively generates parity data so that it can keep all data available and the server running during replacement of a failed drive. The integrated array controller also supports online spare disk drives. These spares are powered up but not active; they are held in reserve in case one or more of the active drives should fail.

The controller supports logical drive expansion, which consists of three different types of operations: capacity expansion, RAID migration, and distribution factor changing. Capacity expansion can occur by either adding additional physical drives or using existing free space on the current physical drives. RAID migration refers to changing the RAID level of an existing logical drive. Distribution factor is the amount of data stored on each physical drive for a RAID stripe. All of these change operations can be performed without disturbing the data on the drives.

The integrated array controller in the ProLiant DL590/64 server can be bypassed using the Integrated Array Bypass Kit and an optional controller such as the Smart Array 5300 controller. The bypass kit is shipped standard with all ProLiant DL590/64 servers.

RAPID DEPLOYMENT AND MAINTENANCE

Design excellence in serviceability and manageability enables rapid setup and deployment and easy management of multiple servers in growing data centers.

Modularity and Serviceability

The ProLiant DL590/64 server builds upon the trend towards modularity and tool-free serviceability. The modular design reduces the demand on technical staff time, making the information technology organization more productive.

The easy-to-remove processor/memory drawer (Figure 14) enables easy access to the memory board. A technician can insert DIMMs without removing the board and minimize downtime by simply removing the memory board, replacing it with a spare, and debugging the board offline.

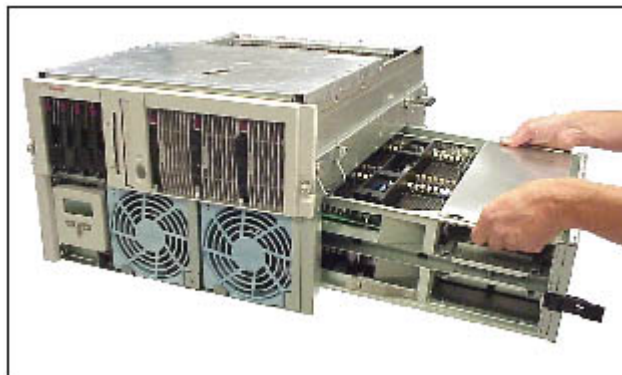


Figure 14: The memory board can be accessed easily through the easy-to-remove processor/memory drawer.

An accessible side plane eliminates the need to replace the system board when SCSI, video, memory, or port repairs are needed. Thumbscrews, easy access panels, and board release levers allow quick access to modular, removable, hot-plug components.

The ProLiant DL590/64 server power subsystem was designed for quick and easy maintenance. The primary power supplies are easily loaded from the front, while the hot-pluggable system power modules are easily replaceable from the top of the server.

Hot-pluggable, redundant fan design offers easy cable-free maintenance. In addition, with the innovative fan design, only two part numbers are required to maintain replacement parts for the 10 fans in the server.

The ProLiant DL590/64 server also features an enhanced PCI Hot Plug implementation. A more ergonomic design of the PCI Hot Plug push button and slot release (Figure 15) makes insertion and removal of PCI adapter cards easier than ever.

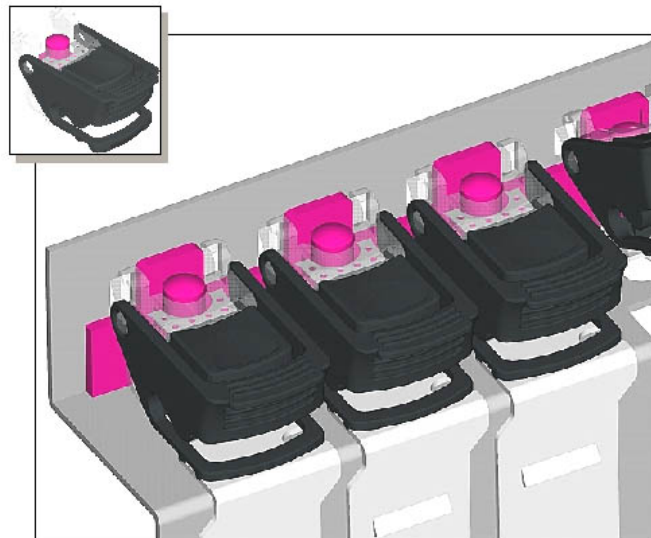


Figure 15: The ProLiant DL590/64 server features an improved PCI Hot Plug implementation.

The ProLiant DL590/64 server also includes light-pipe diagnostic LED indicators that improve serviceability and further reduce downtime associated with upgrades and field maintenance. These indicators allow quick identification to unseated or malfunctioning components.

Manageability

A range of hardware- and software-based server management tools are offered for reducing downtime and increasing productivity. The ProLiant DL590/64 server includes the following standard tools available to all ProLiant servers:

- **Automatic Server Recovery (ASR).** ASR automatically resets the server after a critical hardware or software error. ASR can reset the server to the OS or to the System Partition Utilities. The ASR reset function is based on a hardware timer working in conjunction with the server health drivers. If the server health drivers can no longer reset the hardware timer after some user-specified amount of time, the server is automatically reset. ASR can also be configured to page the administrator when an ASR event occurs.

BIOS – Basic Input
Output System

SNMP – Simple Network
Management Protocol
DMI – Desktop
Management Interface

- **Insight Manager 7.** Insight Manager 7 maximizes system uptime, simplifies system software maintenance, and provides powerful monitoring and control of adaptive infrastructures. Insight Manager 7 delivers pre-failure alerting for ProLiant servers ensuring that potential server failures are detected before they result in unplanned system downtime. Through integration with the Version Control Repository Manager and Version Control Agent, Insight Manager 7 enables version control and remote update of BIOS, drivers, and agents across groups of servers. This enhances system stability, reduces troubleshooting complexity, and reduces the cost associated with maintaining system software configurations. Insight Manager 7 integrates with Windows security for streamlined user administration and strong authentication, and it encrypts management communications using industry-standard Secure Sockets Layer (SSL). Insight Manager 7 is also an effective tool for managing desktops and notebooks as well as other devices instrumented to SNMP or DMI. For more information, go to www.compaq.com/products/servers/management/cim7-description.html.

The ProLiant DL590/64 server ships standard with additional management technologies that reduce downtime and increase productivity even more. Remote Flash Redundant ROM allows administrators to update the read-only memory (ROM) remotely, and the ROM-based Setup (RBSU) saves time during initial server configuration. The Integrated Management Display (IMD) provides essential information at a glance.

ROM-Based Setup

RBSU is a set of installation tools that use embedded ROM-based configuration tools to save time during initial deployment and enable virtual presence anywhere on the network. These tools use SmartStart technology to build the reliable and consistent server configurations that ProLiant customers rely on. SmartStart will not be supported on the ProLiant DL590/64 server.

With RBSU, initial configuration is fast and easy and the server is always available. RBSU includes a look and feel familiar to ProLiant customers. Additionally, RBSU is compatible with SmartStart Scripting Toolkit and automatic system configuration ROM code.

Remote Flash Redundant ROM

The ProLiant DL590/64 server is equipped with a Remote Flash Redundant ROM that improves manageability. Using the Remote ROM Flash Utility, administrators can flash the system ROMs for a wide range of ProLiant servers, locally or across the network. The Remote ROM Flash Utility is a combination of components that allows administrators to upgrade the system ROMs on servers from a single point of execution. The ROM upgrades can either be flashed individually or batched together to perform multiple ROM upgrades in a single step.

Remote Flash Redundant ROM provides a unique redundancy feature that helps ensure system availability and avoid system downtime due to a failure in the ROM flash process. This redundancy feature uses two ROM images and gives the system the ability to recover the last known good system ROM in the event that the current system ROM is corrupted.

When a ProLiant DL590/64 server leaves the factory, both ROM images are identical. Through subsequent boots of the server, if integrity errors are detected by the boot block, the system will automatically launch the redundant image and continue the POST process. If the redundant ROM is launched, the user will see an error message identifying the faulty system ROM.

For more information, refer to the technology brief *Compaq Remote-Flash Redundant ROM Technology*.

Integrated Management Display

The IMD is a backlit liquid crystal display that allows administrators to enter server and contact information. Just as importantly, the IMD presents critical information, warning messages, and error messages in an easy-to-understand format.

A 5-volt auxiliary power line supplies power to the IMD whenever the server power line is plugged in. Even if the server power goes down, the auxiliary line continues to power the IMD so that critical information, such as the last error message and the administrator's name, can be obtained.

The IMD unit contains its own static memory. This memory contains the software code to control the IMD and the text messages shown on the display. All software enhancements added in the future will be available through a flashable ROMPaq. During POST, all event logs, system information, and administrator information are uploaded from the system nonvolatile RAM. During runtime, new events are stored in the nonvolatile RAM and the IMD static RAM (SRAM). If the IMD unit is removed and replaced, all key event and system information is still available.

COMMITMENT TO INDUSTRY-STANDARD 64-BIT COMPUTING

To take advantage of the full performance capabilities of the Itanium processor, customers will need to run 64-bit OSs. Compaq will support the use of 64-bit versions of Windows Advanced Server, Limited Edition (Windows Enterprise Server in the .NET production version), Red Hat Linux 7.2, and SuSE Linux Enterprise Edition.

To realize the full performance benefits of the Itanium processor, customers will also need to use 64-bit applications. Since this is an entirely new processor, solution stacks that include the IA-64 OSs, applications, and backup software will be limited at first. As time goes on, however, more solution stacks will be available for the Itanium processor family. Compaq is working with major software vendors to ensure that applications are available for those customers who will initially benefit most from the ProLiant DL590/64 server.

Initially, customers using applications that can take advantage of the ProLiant DL590/64 server's large memory footprint will benefit most. As mentioned earlier, the ProLiant DL590/64 server will support up to 64 GB of main memory. That's four times more than most servers available today and will benefit applications that move large amounts of data in and out of memory. In some cases, entire databases may be able to fit in memory so that the server never needs to access data from the disk. The ProLiant DL590/64 server will offer significant performance improvements in this type of environment.

Customers who use Terminal Services can also expect improved performance with the ProLiant DL590/64 server. Terminal Server is very dependent on the amount of kernel space that the OS makes available. The 64-bit Windows Advanced Server, Limited Edition OS allows much more kernel memory space and will enable customers to greatly increase the number of users.

Compaq is partnering with leading application vendors such as Microsoft, Oracle, SAP, JD Edwards, SAS, Veritas, Legato, and BMC to ensure 64-bit applications will be available. Compaq has also invested in developing 64-bit versions of standard ProLiant system management tools.

These tools include a new 64-bit version of next-generation SmartStart that assists users with installing OSs and other software and a new support CD that includes several diagnostic tools and system utilities.

Compaq has developed new 64-bit Insight Manager agents to support Insight Manager XE. In addition, Compaq has developed 64-bit versions of the Power Supply Viewer, IML Viewer, IMD Configuration Utility, and the enhanced idle screen utility as a part of a new web-based management suite.

Additionally, Compaq will provide 64-bit drivers for the latest versions of Compaq's popular PCI options cards, including the Smart Array 5300, Intelligent Fibre Channel host bus adapter, and the NC3134 Dual 10/100 gigabit upgradeable NIC.

CONCLUSION

The ProLiant DL590/64 server offers customers a high-performance entry into the 64-bit technology arena. The server provides all the high-availability features customers have come to expect from ProLiant servers plus integrated management technologies and revolutionary serviceability features that further reduce downtime and improve manageability.

For customers needing the greater performance of a 64-bit architecture combined with availability, manageability, and serviceability, the ProLiant DL590/64 server is an excellent choice. Development of this server demonstrates Compaq's commitment to provide industry-standard servers that exceed customer expectations. As business requirements become more demanding, Compaq will continue to deliver servers that meet those requirements and can be expanded to meet future needs.